

CLAIMS

1. A signal detecting circuit which irradiates a pulse light from a light emitting element to a windshield of a vehicle, receives a reflected light by a light receiving element, processes the pulse signal from the light receiving element and inputs it to a processing unit in order to control a wiper of the vehicle, comprising:
- a current – voltage converter circuit for converting the pulse signal from said light emitting element to a voltage signal;
 - an outside-light component reducing circuit provided in parallel with said current – voltage converter circuit for reducing an outside light component included in an output signal of said current – voltage converter circuit; and
 - a band-pass filter circuit/amplifier circuit for reducing a noise of the output signal of said current – voltage converter circuit and for amplifying the output signal.
2. A signal detecting circuit which irradiates a pulse light from a light emitting element to a windshield of a vehicle, receives a reflected light by a light receiving element, processes the pulse signal from the light receiving element and inputs it to a processing unit in order to control a wiper of the vehicle, comprising:
- a current – voltage converter circuit for converting the pulse signal from said light emitting element to a voltage signal;
 - an outside-light component reducing circuit provided in parallel with said current – voltage converter circuit for separating frequency of an outside light component included in an output signal of said current – voltage converter circuit and feeding it back to the input side of said current – voltage converter circuit; and
 - a band-pass filter circuit/amplifier circuit for reducing a noise of the output signal of said current – voltage converter circuit and for amplifying the output signal.

3. A signal detecting circuit according to claim 2, wherein said outside-light component reducing circuit includes

a low-pass filter circuit for passing said outside light component, and

5 an outside-light component voltage – current converter circuit for converting said passed outside light component to an electric current and feeding it back to the input side of said current – voltage converter circuit.

4. A signal detecting circuit according to claim 3, wherein said
10 light emitting element is a light emitting diode and said light receiving element is a photodiode.

5. A signal detecting circuit according to claim 2, 3 or 4, wherein said outside light component includes a constant outside light component and a fluctuating outside light component.

15 6. A signal detecting circuit which irradiates a pulse light from a light emitting element to a windshield of a vehicle, receives a reflected light by a light receiving element, processes the pulse signal from the light receiving element and inputs it to a processing unit in order to control a wiper of the vehicle, comprising:

20 a current – voltage converter circuit for converting the pulse signal from said light emitting element to a voltage signal;

an outside-light component reducing circuit provided in parallel with said current – voltage converter circuit for holding a constant outside light component included in an output signal of said current –
25 voltage converter circuit and feeding it back to the input side of said current – voltage converter circuit; and

a band-pass filter circuit/amplifier circuit for reducing a noise of the output signal of said current – voltage converter circuit and for amplifying the output signal.

7. A signal detecting circuit according to claim 6, wherein a low-pass filter circuit is further provided inside said band-pass filter circuit/ amplifier circuit for reducing a high frequency component of the fluctuating outside-light component.

5 8. A signal detecting circuit according to claim 6 or 7, wherein said outside-light component reducing circuit includes
a switch circuit connected to the output side of said current – voltage converter circuit,
an outside-light component voltage holding circuit connected to
10 said switch circuit for holding the voltage of an outside light component, and
an outside-light component voltage – current converter circuit connected to said outside-light component holding circuit for converting the held voltage to an electric current and feeding it back
15 to the input side of said current – voltage converter circuit.

9. A signal detecting circuit according to claim 8, wherein said switch circuit is turned on when said light emitting element is turned off, and
said switch circuit is turned off when said light emitting element
20 is turned on.

10. A signal detecting circuit according to any one of claims 6 to 9, wherein said light emitting element is a light emitting diode, and said light receiving element is a photodiode.

11. A signal detecting method in which a pulse light is irradiated
25 from a light emitting element to a windshield of a vehicle, a reflected light is received by a light receiving element, the pulse signal from the light receiving element is processed and inputted to a processing unit in order to control a wiper of the vehicle, comprising the steps of:
converting the pulse signal from said light emitting element to a

voltage signal;
reducing an outside light component included in said voltage
signal converted; and
reducing a noise of said voltage signal and amplifying the voltage
5 signal.

12. A signal detecting method in which a pulse light is irradiated
from a light emitting element to a windshield of a vehicle, a reflected
light is received by a light receiving element, the pulse signal from the
light receiving element is processed and inputted to a processing unit
10 in order to control a wiper of the vehicle, comprising the steps of:

converting the pulse signal form said light emitting element to a
voltage signal;
separating frequency of an outside light component included in
said voltage signal converted and feeding it back; and
15 reducing a noise of said voltage signal and amplifying the voltage
signal.

13. A signal detecting method according to claim 12, wherein the
step for feeding back said outside light component includes
a step for filtering said outside light component; and
20 a step for converting the filtered voltage to an electric current and
adding the converted current to said pulse signal.

14. A signal detecting method according to claim 12 or 13,
wherein said outside light component includes a constant outside-light
component and a fluctuating outside-light component.

25 15. A signal detecting method in which a pulse light is irradiated
from a light emitting element to a windshield of a vehicle, a reflected
light is received by a light receiving element, the pulse signal from the
light receiving element is processed and inputted to a processing unit
in order to control a wiper of the vehicle, comprising the steps of:

converting the pulse signal from said light emitting element to a voltage signal;

feeding back a constant outside light component included in said converted voltage signal; and

5 reducing a noise of said voltage signal and amplifying the voltage signal.

16. A signal detecting method according to claim 15, wherein the step for feeding back said outside light component includes

a step for holding the voltage of the outside light component; and

10 a step for converting the held voltage to an electric current and adding the converted current to said pulse signal.

17. A signal detecting method according to claim 15, further comprising a step for reducing a high frequency component of a fluctuating outside-light component.

15 18. A signal detecting method according to claim 17, wherein the step for feeding back said outside light component includes

a step for holding the voltage of a constant outside-light component; and

20 a step for converting the held voltage to an electric current and adding the converted current to said pulse signal.

19. An outside-light component reducing circuit for reducing an outside light component in a signal detecting circuit which irradiates a pulse light from a light emitting element to a windshield of a vehicle, receives a reflected light by a light receiving element, processes the
25 pulse signal from the light receiving element and inputs it to a processing unit in order to control a wiper of the vehicle, characterized in that the outside-light component reducing circuit is provided in parallel with a current – voltage converter circuit for converting the pulse signal from said light emitting element to a voltage signal, for

separating frequency of an outside light component included in the output signal of said current – voltage converter circuit and for feeding it back to the input side of said current – voltage converter circuit.

5 20. An outside-light component reducing circuit according to claim 19, further comprising:

 a low-pass filter circuit for passing said outside light component;

and

 an outside-light component voltage – current converter circuit for

10 converting said passed outside light component to an electric current and feeding it back to the input side of said current – voltage converter circuit.

 21. An outside-light component reducing circuit according to claim 20, wherein said light emitting element is a light emitting diode

15 and said light receiving element is a photodiode.

 22. An outside-light component reducing circuit according to claim 19, 20 or 21, wherein said outside light component includes a constant outside-light component and a fluctuating outside-light component.

20 23. A method, when irradiating a pulse light from a light emitting element to a windshield of a vehicle, receiving a reflected light by a light receiving element, processing a pulse signal from the light receiving element and inputting it in a processing unit in order to control a wiper of the vehicle, for reducing an outside light component

25 of said processed pulse signal, comprising the steps of:

 filtering said outside light component; and

 converting the filtered voltage to an electric current and adding the converted current to said pulse signal.

24. A method for reducing an outside light component according to claim 23, wherein said outside light component includes a constant outside-light component and a fluctuating outside light component.

25. An outside-light component reducing circuit in a signal
5 detecting circuit which irradiates a pulse light from a light emitting element to a windshield of a vehicle, receives a reflected light by a light receiving element, processes a pulse signal from the light receiving element and inputs it to a processing unit in order to control a wiper of the vehicle, for reducing said constant outside-light
10 component, characterized in that the outside-light component reducing circuit is provided in parallel with a current – voltage converter circuit for converting the pulse signal from said light emitting element to a voltage signal for holding an outside light component included in an output signal of said current – voltage converter circuit and feeding it
15 back to the input side of said current – voltage converter circuit.

26. An outside-light component reducing circuit according to claim 25, further comprising:

a switch circuit connected to the output side of said current – voltage converter circuit;

20 an outside-light component voltage holding circuit connected to said switch circuit for holding the voltage of the outside light component; and

an outside-light component voltage – current converter circuit connected to said outside-light component voltage holding circuit for
25 converting the held voltage to an electric current and feeding it back to the input side of said current – voltage converter circuit.

27. An outside-light component reducing circuit according to claim 25 or 26, wherein said light emitting element is a light emitting diode and said light receiving element is a photodiode.

28. A method, when irradiating a pulse light from a light emitting element to a windshield of a vehicle, receiving a reflected light by a light receiving element, processing a pulse signal from the light receiving element and inputting it to a processing unit in order to
5 control a wiper of the vehicle, for reducing an outside light component of said processed pulse signal, comprising the steps of:

holding the voltage of the outside light component; and

converting the held voltage to an electric current and adding the converted current to said pulse signal.